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(11) Veröffentlichungsnummer:
(11) Publication number:
(11) Numéro de publication:

0 3 9 7 6 8 0

**Internationale Anmeldung veröffentlicht durch die
Weltorganisation für geistiges Eigentum unter der Nummer:**

WO 89/05266 (art.158 des EPÜ).

**International application published by the World
Intellectual Property Organisation under number:**

WO 89/05266 (art.158 of the EPC).

**Demande internationale publiée par l'Organisation
Mondiale de la Propriété Intellectuelle sous le numéro:**

WO 89/05266 (art.158 de la CBE).

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(19)



Europäisches Patentamt

European Patent Office

Office européen des brevets



(11) Publication number:

0 397 680 B1

(12)

EUROPEAN PATENT SPECIFICATION

(49) Date of publication of patent specification: 26.01.94 (51) Int. Cl.⁵: **B65B 69/00**

(21) Application number: 89900557.3

(22) Date of filing: 02.12.88

(86) International application number:
PCT/US88/04304

(87) International publication number:
WO 89/05266 (15.08.89 89/13)

(54) **METHOD AND APPARATUS FOR DEBANDING MAIL BUNDLES.**

(30) Priority: 02.12.87 US 127802

(43) Date of publication of application:
22.11.90 Bulletin 90/47

(45) Publication of the grant of the patent:
26.01.94 Bulletin 94/04

(84) Designated Contracting States:
AT BE CH DE FR GB IT LI LU NL SE

(56) References cited:
US-A- 4 404 723
US-A- 4 553 312
US-A- 4 660 818

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EP 0 397 680 B1

Description

This invention relates to devices for removing elastomeric bands from bundles of objects, particularly bundles of postal envelopes.

Sheet-like objects, particularly envelopes, are frequently secured in bundles by elastomeric "rubber bands". Rubber bands are easier to apply manually than bands made of a non-elastic material such as paper. Rubber bands can stretch to accommodate bundles of various shapes and sizes. And, the rubber bands can be re-used after the bundle is broken.

Postal services process large quantities of mail bundles secured by rubber bands. By regulation, certain mailers must provide mail banded bundles to aid automated handling. Bundles are to be secured with rubber bands of certain specified characteristics. Even the positioning of the bands is specified by regulation, although not every mailer conforms to the specifications. Presently, prior to sorting, the rubber bands are most commonly removed by hand. The removed bands are collected and returned to the mailers for reuse.

Manually removing the rubber bands is a labor-intensive and tedious job. It would be preferable to remove the bands by machine. But, heretofore, there has been no automated mechanism to remove rubber bands from bundles that may vary in size and shape.

Prior devices, such as those shown in U.S. Patents Nos. 4,404,723 of Ohba et al. and 4,553,312 of Mitzel et al. are used for removing paper bands from bundles of currency. Such devices, however, will only work with very uniformly sized and shaped bundles, such as bundles of currency. Thus, the prior devices are not suitable for debanding mail bundles which are not inherently uniform in size, shape, or banding pattern.

US-A-4,414,730 (OHMURA et al) discloses a device for removing bands from bundles of bank notes by holding the bank notes in position with two levers, sandwiching the band between a magnet and a magnetic plate to prevent the band from moving, inserting a knife into the bundle, to as small a depth as possible and moving the knife to cut the band. The individual bank notes are then separated from the bundle by a roller.

SUMMARY OF THE INVENTION

The present invention is an apparatus and method for removing elastomeric bands that encircle bundles of mail. The bundles are carried to a work station on a conveyor. Apparatus at the work station includes clamps for grasping a bundle and a blade-like member which is inserted into the bundle and then moved in such a manner as to

grasp a lengthwise rubber band and pull it free. Girthwise bands are removed by pulling the bundle away from the blade while the blade is positioned to retain any girthwise bands. Using this apparatus and method, both lengthwise and girthwise bands are removed, regardless of the order in which the bands were placed on the bundle.

The blade is operated by one or more actuators, preferably air cylinders, which are directed by a control mechanism. Depending on the nature of the bundles to be sorted, a spreader mechanism can be used to open and maintain a gap between two envelopes of the bundle to ease insertion of the blade. After the rubber bands are removed at the work station, the bundles can be automatically deposited in a tray of the type used to feed automated sorting machines.

The apparatus and method of the present invention are designed to avoid damaging the banded envelopes. In particular, the spreader mechanism is designed to protect against inadvertent puncture of "window" envelopes by the debanding blade or by other elements of the apparatus.

It is thus an object of the invention to automatically remove rubber bands which encircle bundles of sheet-like objects, particularly letter bundles.

A further object is to provide a mechanism for removing both lengthwise and girthwise rubber bands, regardless of the order in which the bands are applied or the position of the bands on the bundle.

A particular object is to remove such rubber bands without damage to envelopes.

Another object is to automatically insert mail bundles into a sorting tray after rubber bands have been automatically removed.

These and other features, advantages and object of the invention will be best understood with reference to the detailed description and drawings.

In accordance with one aspect of the present invention, an apparatus for removing and securing band is provided having the features of claim 1.

In another aspect, the present invention provides a method of removing a band comprising the features of claim 16.

In order that the invention may be more readily understood, an embodiment of the invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a vertical sectional view of an apparatus according to the present invention for removing rubber bands from bundles of envelopes;

Figure 2 is a sectional view taken along line 2-2 of Figure 1;

Figure 3 is a sectional view taken along line 3-3 of Figure 1;

Figure 4 is a sectional view taken along line 4-4 of Figure 1;

Figure 5 is a partial sectional view taken along line 5-5 of Figure 4;

Figure 6 is a partial sectional view taken along line 6-6 of Figure 1;

Figure 7 is a perspective, schematic view of a bundle of mail positioned at the debanding station of the apparatus shown in Figure 1;

Figure 8 is a perspective, schematic view of the bundle shown in Figure 7 with a spreader blade inserted;

Figure 9 is a perspective, schematic view of the bundle shown in Figure 7 with a blade having moved a lengthwise rubber band away from one end of the bundle;

Figure 10 is a perspective, schematic view of the bundle shown in Figure 7 with a band engaging blade inserted after a lengthwise rubber band has been released; and

FIG. 11 is a perspective, schematic view of the bundle of FIG. 7, after all rubber bands have been removed, and of a mechanism for positioning the bundle in a sorting tray.

DETAILED DESCRIPTION

A conveyor mechanism 20 carries a bundle of mail, encircled by rubber bands, to a work station where a positioning mechanism 21 clamps onto the bundle. While secured by the positioning mechanism at the work station, a debanding mechanism 22 is used to remove the bands. A transport mechanism 24 works with the debanding mechanism and carries the bundle, after it has been debanded, and positions it into a sorting tray. The conveyor mechanism 20 includes an endless conveyor belt 30 which extends around a drive roller 31 and an idler roll (not shown). The drive roller 31 is connected by a drive shaft 32 to a drive motor or drive gear mechanism 33.

Mail bundles 34 are deposited on the belt with longitudinal edges 36 of the envelopes seated on the belt 30. For convenience in later handling, each bundle is placed on the conveyor in the same orientation. The orientation is identified by the location of a stamp 38. A stamp sensor 40, such as a detector sensitive to conductive postage stamp ink, may be positioned alongside the conveyor to verify the orientation of the bundle and reject any bundle not properly oriented. By regulation, all the envelopes within a bundle have the same orientation.

Along the conveyor belt 30 are one or more sets of mail support brushes or fingers 42. The brushes, which are preferably made of spring steel, are positioned to vertically align and support passing bundles and to center the bundles over the belt 30.

The conveyor mechanism 20 carries the bundles to a work station where the bundle is supported by a platform 44. The positioning mechanism 21 and the debanding mechanism 22, which in the illustrated embodiment are supported by a frame 46, are located at the work station. A limit sensor 47 signals when a bundle arrives in position on the platform 44 for debanding. The illustrated sensor is a switch with a hinged, spring-loaded throw lever positioned to be pushed aside by bundles traveling along the conveyor.

The positioning mechanism 21 is provided to position the workpiece bundle in relation to the debanding mechanism 22 and to position the bundle for receipt by the transport mechanism 24 after all lengthwise rubber bands are removed. This positioning mechanism 21 includes a clamp assembly 48 which consists of a pair of opposed friction pads 50 mounted on plates 52 on the distal ends of actuator shafts 54. The shafts 54 extend from actuators 56. For speed of operation and cleanliness, the actuators 56 and all other actuators mentioned herein are preferably air cylinders. The actuators 56 are mounted on a carriage 58 for movement, along a path defined by channel members 59 and spacer bars 60, parallel to the upper surface of the belt 30. The carriage 58 is moved by actuators 61 which are pivotally secured at one end to the frame 46 by means of connection brackets 62. Actuator shafts 64 are pivotally mounted to the carriage 58 by means of connection brackets 66.

The debanding mechanism 22 is contained within a housing 70 which is mounted to the frame 46 and has a floor 71. Three actuators are mounted to the housing. The first actuator 72 has an extendible shaft 74 connected to a nozzle carriage 76 mounted for vertical movement along parallel rails 78. The carriage 76 mounts an air nozzle 80, connected by a flexible hose 82 to a source of pressurized air (not shown). The second actuator 86 has an extendible and rotatable shaft 88 attached to a spreader blade 90 which has a helical portion 92 near its connection with the shaft 88. A third actuator 96 has an extendible shaft 98 connected to a carriage 99. The carriage 99 mounts a rubber band engaging blade 100, which is mounted for pivotal, pendulum-like motion around an axis A. The blade 100 has a detent 101 or other hook-like element to retain rubber bands. Blade 100 is also pivotally mounted by means of a connector 104 to the shaft 106 of an actuator 108, which in turn is pivotally mounted to the carriage 99. The carriage 99 extends through an opening 110 in a wall of the housing 70. When extended during operation, each of the nozzle 80, spreader blade 90 and band engaging blade 100 extend through a slot 112 defined by the floor 71 of the housing 70, as shown in FIG. 6.

A chute 114 is provided, below the debanding mechanism 22 and conveyor belt 30, to collect rubber bands after they are removed from the bundles.

The transport mechanism 24 holds and pulls the bundle 34 past the blade 100 during a portion of the debanding operation and moves the debanded mail bundles into a sorting tray 116, which has a leading wall 118. This transport mechanism has a clamping mechanism 119, including opposed pairs of friction pads 120 for engaging opposite faces of a bundle 34. The friction pads 120 are supported by plates 122 which are suspended from mounting brackets 124. Brackets 124 are horizontally movable by means of actuators 128 which are connected to the brackets 124 by shafts 130. The actuators 128 are mounted on a carriage 132. Stabilizing shafts 136 are mounted on the mounting brackets 124 and positioned to extend through sleeves 138 on the carriage 132.

The carriage 132 is also mounted for horizontal sliding movement between opposed track guides formed by channel members 142. Horizontal motion of the carriage 132 is achieved by means of an actuator 144 pivotally mounted to the frame 46, a shaft 146 connects the piston of the actuator 144 and the carriage 132. Sensors 148, 150, which may be micro switches, photo cells or equivalent devices, are mounted on the frame 46 to detect the positions of the carriage 132 when the shaft 146 is fully extended or fully retracted.

The actuator 144 is pivotally mounted to a carriage member 156. The carriage 156 is mounted for vertical movement between track guides formed by opposed channel members 158. An actuator 160, mounted to the frame 46, has a shaft 162 which extends between the actuator piston and the carriage 156. Sensors 163, 164 detect and signal the location of the carriage 156 when it is fully raised or lowered.

Sorting trays 116 are provided on a pathway at the end of the conveyor mechanism. In the illustrated embodiment, a channel is defined by a support surface 168, which may consist of a series of rollers (not shown), and guide rails 170. A mechanism is provided for supporting debanded envelopes after they have been deposited in a tray 116 and for advancing the tray as it fills. This apparatus includes an actuator 176 mounted to the frame 46, with a shaft 178 which extends horizontally, transversely to the belt 30. A support arm 180 extends radially from the free end of the shaft 178. The shaft 178 is of a hexagonal or other non-circular cross section, and extends through a mating collar 182, as shown in FIG. 5. The collar 182 is constructed such that the shaft 178 can slide axially through the collar, but is keyed to the collar so that rotation of the collar causes rotation of the shaft.

Extending radially from the collar 176 is a lever arm 184, which is pivotally mounted to the shaft 186 of an actuator 188. The actuator 188 is mounted to the body of the actuator 176 and thereby to the frame 46. This is accomplished using a bracket 190, which is connected to the body of the actuator 176 and pivotally connected to the actuator 188 so that operation of the actuator 188 causes the shaft 178 to rotate.

Operation of the invention is best understood with reference to FIGS. 7-11. Bundles of envelopes 34 are placed on the conveyor belt 30 by an operator or automated mechanism. Bundles in accord with postal regulations will be encircled and girded by one lateral or girthwise rubber band 194 and, depending on the size of the bundle, by one longitudinal or lengthwise rubber band 196. In practice, bundles will vary in size and some will have multiple girthwise rubber bands. The bands will not necessarily be centered. Such irregularities do not affect operation of the present invention.

Each bundle includes a front face 202 showing an address and a stamp, and a rear face 204 showing the reverse side of an envelope, all the envelopes in the stack being uniformly faced. The edges of the envelopes define edge faces of the bundle, including a leading edge face 208, a trailing edge face 210, a top edge face 212 and a bottom edge face 214. The end faces, including leading and trailing edge faces 208, 210 are defined by lateral edges of the envelopes, and the top and bottom edge faces 212, 214 are defined by the longitudinal edges of the envelopes in the bundle. The edge faces intersect at leading top corners 218, leading bottom corners 220, trailing top corners 222, and trailing bottom corners 224.

A bundle is carried by the belt 30 between the brushes 42 until it engages the limit switch 47 (FIG. 1). Upon receipt of the signal from the sensor 47, the actuators 56 operate to extend shafts 54 so that the friction pads 50 engage front and rear faces 202, 204 of the bundle to temporarily prevent any bundle movement. And, the actuator 72 extends shaft 74 to position the nozzle 80 above the top edge face 212 of the bundle.

When the nozzle 80 is in position, a valve (not shown) is opened to the air supply so that a jet of air issues from the nozzle 80. At the center of the jet, the upper longitudinal edges of two adjacent envelopes are forced apart at the top edge face 212 of the bundle to create a gap 230 as shown in FIG. 7.

A second actuator 86 then operates to extend the shaft 88 so that the separator blade 90 extends into the gap 230. As the helical portion 92 of the blade passes through the slot 112, the helical portion 92 acts as a cam which causes rotation of the blade 90 to the position shown in FIG. 8. Rotation

of the blade widens and maintains the gap 230.

Next, the actuator 96 operates to extend the band-engaging blade 100 into the gap 230. The actuator 108 then extends shaft 106 to swing the blade 100 to the right-hand position shown in FIG. 9. As the blade 100 swings, the third actuator 96 retracts the shaft 98 to raise the overall elevation of the blade 100. As a result, any lengthwise rubber band is lifted to a height where it clears the corners 218. The actuator 108 is then operated to retract the shaft 106 so that the blade swings to a position shown at the left of FIG. 9, the nozzle 80 and blade 90 having been previously raised by the actuators 72, 86. As the blade 100 swings to the left, the rubber band 196 is released from the detent 101 of the blade 100. Depending on the positioning of the rubber band 196 on the bundle 34, it may fall away from the bundle, or be temporarily retained by the girthwise rubber band 194 or pressure pads 50, as illustrated by the broken lines in FIG. 9.

Next, the actuator 108 partially extends the shaft 106 to return the blade 100 to a centered position, whereupon the actuator 96 operates to extend the blade downwardly through the top edge face 212 and into the bundle. The reinsertion of the blade 100 can be assisted by a jet of air from the nozzle 80 and/or use of the spreader blade 90, but such assistance may not be necessary once the bundle is loosened by displacement of the lengthwise rubber band 196.

Once the blade 100 is reinserted, the actuator 60 retracts shafts 64 to move the carriage 58 downstream a distance D to a position where the clamp assembly 48, which comprises friction pads 50, plate 52 and shafts 54, is in the longitudinally displaced position shown by broken lines in FIGS. 1 and 4. When in the displaced position, a leading or downstream portion of the bundle extends beyond the blade 100 and between the friction pads 120, the actuators 128 operate to extend the shafts 130 and cause the friction pads 120 to engage and hold the bundle at a location downstream of the blade 100 and thus downstream of the girthwise rubber band 194. The shaft 54 is then retracted by the actuators 56 so that the bundle is disengaged from the positioning mechanism 21.

The actuators 144 then operate to retract the shaft 146 which pulls the carriage 132 and its associated bundle downstream while the blade 100 remains within the bundle. As the bundle 34 is moved to the position shown in FIG. 11, any rubber bands still retained on the bundle are trapped behind the blade 100 and are thus stripped off the bundle. The rubber bands fall into the chute 114 for collection in a bin (not shown). A blast of air from the nozzle 80 will blow off any rubber bands which may fall onto the belt 30.

When the bundle of envelopes is positioned over the sorting tray 116 as signaled by the sensor 150, actuators 160 operate to extend shafts 162, which lowers the carriage 156, plates 122, friction pads 120 and the bundle 34 held therebetween. The bundle is thus moved to a position, shown by broken lines in FIG. 11, where it is received within the tray 116.

Next, the actuator 188 operates to retract the shaft 186, causing the support arm 180 to rotate to a horizontal position above the top edge face 212 of the bundle 34. Any previously deposited envelopes 234 are retained in position in the tray 116 by the proximity of one of the plates 122. The actuator 176 then operates to extend the shaft 178 so that the support arm 180 moves across the longitudinal axis of the conveyor belt 30 to a position beyond the rear face 204 of the bundle 34. The actuator 188 is then operated to extend the shaft 186 so that the support arm 180 rotates to the six-o'clock position, as shown by broken lines in FIG. 3. The actuators 128 then operate to retract the shafts 130, thereby disengaging the friction pads 120 from the bundle 34. The actuators 160 operate to retract the shafts 162, which in turn lifts the clamp mechanism 119 comprising the friction pads 120 and support plates 122 from the tray 116. The actuators 144 then operate to extend the shafts 146 to a position such that the clamp mechanism 119 is positioned to receive the next bundle. The extent to which the shaft 146 is extended is determined by the sensor 148, which detects the arrival of carriage 132.

As the transport mechanism 24 is returning to its starting position, the actuator 176 operates to retract the shaft 178 so that the support arm 180 engages the rear face 204 of the bundle 34, which pulls the bundle 34 laterally until the front face 202 of the bundle 34 engages the leading wall 118 of the tray 116 or any previously deposited envelopes 234. As the shaft 178 moves to a fully retracted position, force exerted by the support arm 180 on the rear face 204 of the bundle 34 causes the tray 116 to be moved laterally along the support surface 168 so that the tray 116 will be in position to receive a subsequent bundle. When a tray is substantially full, it will have moved to a position (not shown) at the far left, as viewed in Figure 3. Sensors (not shown) that detect the tray at the far left position cause the tray 116 to be ejected and a new tray positioned to commence receiving bundles delivered by the transport mechanism 24.

The sequence of operation is then repeated.

Having illustrated and described the principles of the present invention, it should be apparent that many of the operating steps mentioned can, and should, occur simultaneously for best efficiency. And, it will be apparent that the apparatus will work

with bundles that omit a lengthwise rubber band or that have multiple spaced girthwise rubber bands.

Claims

1. An apparatus for removing a securing band (194, 196) that encircles a bundle (34) of stacked items, the apparatus comprising: transport means (24) for holding the bundle (34); and band engaging means including a blade (100) movable from a retracted position to an extended position in which the blade is positioned between adjacent items of a bundle held by the transport means (24), which apparatus is characterised by actuator means (144) operative to move a bundle (34) encircled by a rubber band with respect to the extended and stationary blade (100) in a direction to bring the blade (100) into contact with the rubber band (194, 196) so that the band is pulled from the bundle by the blade during continued movement of the bundle (34) without cutting the band.
2. An apparatus according to Claim 1, wherein the girth of the bundle (34) is encircled by the band (194).
3. An apparatus according to Claims 1 or 2, wherein the transport means (24) comprises a clamp mechanism.
4. An apparatus according to any preceding claim, wherein the band-engaging means further comprises spreader means (90) mounted for insertion between the two adjacent items of the bundle (34) to maintain a gap between the adjacent items during the insertion of the blade (100), the spreader means (90) comprising: a spreader blade (90) having parallel faces; and a spreader movement mechanism (86, 92, 112) for maintaining the spreader blade faces generally parallel to the faces of the adjacent items during the insertion of the spreader blade (90) between the adjacent items and for rotating the spreader after the insertion so that the spreader blade (90) faces are generally perpendicular to the faces of the adjacent items and a gap is maintained between the adjacent items.
5. An apparatus according to any preceding claim further comprising: positioning means (21) for positioning the bundle (34) relative to the band-engaging means.
6. An apparatus according to Claim 5 further comprising conveyer means (30) for conduct-

ing bundles (34) to the positioning means (21).

7. An apparatus according to Claim 6 further comprising: a platform (44) to support a bundle (34); and sensor means (47) to detect when a bundle (34) arrives at the platform (44) and to stop the conveyer means (30) when a bundle (34) is detected.
8. An apparatus according to any one of Claims 5 to 7, wherein the band-engaging means further comprises air nozzle means (80) positionable to direct a jet of air toward a side face of a bundle (34) held by the positioning means (21) or by the transport means (24) so as to open a gap between two adjacent items of the bundle (34).
9. An apparatus according to Claim 8 for use with a bundle (34) of stacked items secured by a lengthwise girding rubber band (196), wherein the blade (100) is pivotally mounted for movement in a plane parallel to the faces of the items of a bundle (34) held by the positioning means (21) or by the transport means (24); and actuator means (108) pivotally move the blade (100) into contact with the length-wise girding rubber band (196) and remove the rubber band (196) from at least one end face of the bundle (34) without cutting the band (196).
10. An apparatus according to Claim 9, wherein the blade (100) is adapted to move a portion of the lengthwise girding rubber band (196) around a pair of corners (218) of the bundle (34) where two side faces of the bundle (34) (208, 212) meet a front face (202) of the bundle (34) and where the two side faces (208, 212) meet a rear face (204) of the bundle (34).
11. An apparatus according to any one of Claims 8 to 10, further comprising sensors (40) to confirm that each bundle (34) on the conveyer belt (30) is properly faced, and to signal the position of a bundle (34) along its pathway; and programmed control means, responsive to the sensors for operating the conveyer belt (30), positioning means (21), actuator means (56), nozzle means (80), spreader movement mechanism (86, 92, 112) and transport means (24).
12. An apparatus according to any preceding claim, wherein the blade (100) has a detent (101) at its distal end for hooking rubber bands (194, 196).

13. An apparatus according to any preceding claim further comprising stacking means for stacking debanded bundles in a storage box (116).
14. An apparatus according to Claim 13, wherein the stacking means comprises; clamp means (24) for engaging front and rear faces (202, 204) of a debanded bundle (34), actuator means (144) for moving the clamp means (24) and any associated bundle (34) between a position adjacent the blade (100) and a position over a storage box (116) having a rigid side wall (118); actuator means (160) for moving the clamp means (24) and any associated bundle (34) between a position above the box (116) to a position within the box (116) and; a support member (180) for maintaining inserted bundles (34) in front-face (202) to rear-face (204) alignment and against the wall (118) of the box (116).
15. An apparatus according to any preceding claim comprising chute means (114) located to collect rubber bands (194,196) after they are removed from a bundle (34), pairs of brushes positioned along the conveyer belt to centre and support passing bundles; a support member for maintaining bundles in front-face to rear-face alignment and against the wall of the storage box after they are inserted by the transport means and for applying pressure to advance the box.
16. A method of removing a band (194, 196) that encircles a bundle (34) of stacked items comprising the steps of: presenting the bundle (34) at a workstation; holding the bundle (34) in position at the workstation; inserting a band-engaging means including a blade (100) between adjacent items of the bundle (34); bringing the blade (100) and the band (194, 196) into contact with one another; characterised by the steps of: extending the blade (100) from a retracted position to an extended position such that the blade (100) is located in the extended position between adjacent items of the bundle (34) encircled by a rubber band (194, 196); keeping the blade (100) stationary in the extended position; moving the bundle (34) relative to the stationary and extended blade (100) such that the blade (100) is brought into contact with the rubber band (194, 196), the continuous movement of the bundle (34) pulling the rubber band (194,196) off the bundle (34) without cutting the rubber band (194, 196); and discharging the debanded bundle (34) from the workstation.

17. A method according to Claim 16, wherein before the step of bringing the blade (100) and the band (194, 196) into contact with one another is carried out, the band engaging means swings in a pendulum-like manner and a portion of the band engaging means contacts a length-wise girding rubber band (196) and the upward motion of the pendulum-like swing pulls the rubber band (196) from at least one face of the bundle (34).
18. A method according to Claim 17, wherein the bundle (34) is compressed between a first set of clamp pads before the blade is inserted into the bundle, the clamp pads clamping a trailing portion of the bundle; the set of clamp pads are moved downstream to reposition the bundle (34) relative to the blade (100) after swinging the band engaging means in a pendulum-like manner; and compressing the bundle (34) between a second set of clamp pads applied against a leading edge portion of the bundle prior to reinserting the blade, and then withdrawing the first set of clamp pads.

Patentansprüche

- Vorrichtung zum Entfernen eines Sicherungsbandes (194, 196) um ein Bündel (34) gestapelter Gegenstände, welche Vorrichtung umfaßt: eine Transportvorrichtung (24) zum Festhalten des Bündels (34) und eine Bandgreifvorrichtung mit einer einziehbaren und ausfahrbaren Klinge (100), die in ausgefahrenem Zustand zwischen aneinanderliegenden Gegenständen eines durch die Transportvorrichtung (24) festgehaltenen Bündels positioniert wird, wobei die Vorrichtung durch eine Antriebsvorrichtung (144) gekennzeichnet ist, durch die ein Bündel (34), das durch ein Gummiband zusammengehalten wird, relativ zu der ausgefahrenen und ruhenden Klinge (100) in einer Richtung bewegt wird, um die Klinge (100) mit dem Gummiband (194, 196) in Kontakt zu bringen, so daß das Gummiband bei einer fortgesetzten Bewegung des Bündels (34) durch die Klinge von dem Bündel abgezogen wird, ohne das Band zu zerschneiden.
- Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß der Umfang des Bündels (34) der Breite nach von einem Band (194) umgeben ist.
- Vorrichtung nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß die Transportvorrichtung (24) einen Klemmechanismus einschließt.

4. Vorrichtung nach einem der vorangehenden Ansprüche, dadurch gekennzeichnet, daß die Bandgreifvorrichtung mit einer Spreizvorrichtung (90) versehen ist, die so angebracht ist, daß sie zwischen die beiden aneinanderliegenden Gegenstände des Bündels (34) eingeführt werden kann, um zwischen den beiden aneinanderliegenden Gegenständen eine Lücke zum Einführen der Klinge (100) aufrechtzuerhalten, wobei die Spreizvorrichtung (90) umfaßt eine Spreizklinge (90) mit zwei parallelen Seiten und einen Bewegungsmechanismus (86, 92, 112) für die Spreizklinge, um die Seiten der Spreizklinge im allgemeinen parallel zu den Oberflächen der aneinanderliegenden Gegenstände zu halten, während die Spreizklinge (90) zwischen die aneinanderliegenden Gegenstände eingeführt wird, und um die Spreizklinge nach dem Einführen zu drehen, so daß die Seiten der Spreizklinge (90) im allgemeinen in einem rechten Winkel zu den Oberflächen der aneinanderliegenden Gegenstände stehen und eine Lücke zwischen den aneinanderliegenden Gegenständen aufrechterhalten wird.

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5. Vorrichtung nach einem der vorangehenden Ansprüche, gekennzeichnet durch ein Positionierungsmittel (21), um das Bündel (34) relativ zur Bandgreifvorrichtung zu positionieren.

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6. Vorrichtung nach Anspruch 5, gekennzeichnet durch ein Fördermittel (30) zum Zuführen von Bündeln (34) zum Positionierungsmittel (21).

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7. Vorrichtung nach Anspruch 6, gekennzeichnet durch eine Plattform (44) zur Ablage eines Bündels (34) sowie ein Sensormittel (47), das das Eintreffen eines Bündels (34) auf der Plattform (44) feststellt, und das Fördermittel (30) anhält, wenn ein Bündel (34) festgestellt wird.

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8. Vorrichtung nach einem der Ansprüche 5 bis 7, dadurch gekennzeichnet, daß die Bandgreifvorrichtung mit Luftdüsen (80) ausgestattet ist, die sich so ausrichten lassen, daß ein Luftstrom seitlich gegen ein Bündel (34) geblasen wird, während es vom Positionierungsmittel (21) oder vom Transportmittel (24) festgehalten wird, wodurch eine Lücke zwischen zwei aneinanderliegenden Gegenständen des Bündels (34) entsteht.

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9. Vorrichtung nach Anspruch 8 zur Verwendung mit einem Bündel (34) gestapelter Gegenstände, die von einem in Längsrichtung umfassenden Gummiband (196) zusammengehalten werden, dadurch gekennzeichnet, daß die Klinge (100) zur Bewegung in einer zu den Oberflächen der Gegenstände eines vom Positionierungsmittel (21) oder vom Transportmittel (24) gehaltenen Bündels (34) parallelen Ebene schwenkbar gehalten ist, wobei eine Antriebsvorrichtung (108) die Klinge (100) durch eine Schwenkbewegung in Kontakt mit dem in Längsrichtung umfassenden Gummiband (196) bringt und das Gummiband (196) von mindestens einer Stirnseite des Bündels (34) entfernt, ohne das Band (196) durchzuschneiden.

10.
10. Vorrichtung nach Anspruch 9, dadurch gekennzeichnet, daß die Klinge (100) so gestalten ist, daß sie einen Teil des in Längsrichtung umfassenden Gummibandes (196) um ein Eckenpaar (218) des Bündels (34) bewegen kann, wo zwei Seitenflächen des Bündels (34) (208, 212) auf eine Vorderseite (202) des Bündels (34) und die beiden Seitenflächen (208, 212) auf eine Rückseite (204) des Bündels (34) stoßen.

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11. Vorrichtung nach einem der Ansprüche 8 bis 10, gekennzeichnet durch Sensoren (40), um zu bestätigen, daß jedes Bündel (34) in der richtigen Lage auf dem Förderband (30) aufliegt, und um die Position eines Bündels (34) entlang seiner Bahn zu signalisieren, und durch eine programmierte Steuereinheit, die ansprechend auf die Sensoren das Förderband (30), die Positionierungsmittel (21), die Antriebsvorrichtung (56), die Düseninheit (80), den Bewegungsmechanismus für den Spreizer (86, 92, 112) und das Transportmittel (24) steuert.

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12. Vorrichtung nach einem der vorangehenden Ansprüche, dadurch gekennzeichnet, daß die Klinge (100) an ihrem äußeren Ende mit einem Haken (101) zum Einhaken der Gummibänder (194, 196) versehen ist.

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13. Vorrichtung nach einem der vorangehenden Ansprüche, gekennzeichnet durch ein Stapelmittel zum Stapeln der von den Bändern befreiten Bündel in einem Sammelbehälter (116).

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14. Vorrichtung nach Anspruch 13, dadurch gekennzeichnet, daß das Stapelmittel umfaßt: einen Klemmechanismus (24) zum Erfassen der Vorder- und Rückseiten (202, 204) eines vom Band befreiten Bündels (34), eine Antriebsvorrichtung (144) zum Bewegen des Klemmechanismus (24) und eines dazugehörigen Bündels (34) zwischen einer Position in der Nähe der Klinge (100) und einer Position über einem Sammelbehälter (116) mit einer starren Seitenwand (118); eine Antriebsvorrichtung (160) zum Bewegen des Klemmechanismus (24) und ei-

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- nes dazugehörigen Bündels (34) aus einer Position über dem Behälter (116) in eine Position innerhalb des Behälters (116) und ein Stützteil (180), das gewährleistet, daß die Ausrichtung der eingelegten Bündel, Vorderseite (202) auf Rückseite (204) und gegen die Wand (118) des Behälters (116), beibehalten wird. 5
15. Vorrichtung nach einem der vorangehenden Ansprüche, gekennzeichnet durch eine Rutschvorrichtung (114) zum Sammeln der Gummibänder (194, 196) nach ihrer Entfernung von einem Bündel (34), wobei Bürstenpaare entlang des Förderbandes angebracht sind, um die vorbeiziehenden Bündel zu zentrieren und abzustützen, und wobei ein Stützteil dazu dient, die Ausrichtung der Bündel, Vorderseite auf Rückseite und gegen die Wand des Sammelbehälters, beizubehalten, sobald sie vom Transportmittel eingelegt worden sind, und Druck anzuwenden, um den Behälter voranzubewegen. 10 15 20
16. Verfahren zum Entfernen eines Bandes (194, 196), das ein Bündel (34) gestapelter Gegenstände umgibt, die folgenden Einzelschritte einschließend: Vorlegen des Bündels (34) an einer Arbeitsstation, Festhalten des Bündels (34) in seiner Position an der Arbeitsstation, Einführen einer Bandgreifvorrichtung einschließlich einer Klinge (100) zwischen aneinanderliegende Gegenstände des Bündels (34), In-Kontakt-bringen der Klinge (100) und des Bandes (194, 196), gekennzeichnet durch folgende Schritte: Ausfahren der Klinge (100) aus einer eingezogenen in eine ausgefahrene Position, so daß die Klinge (100) in der ausgefahrenen Position zwischen zwei aneinanderliegenden Gegenständen des von einem Gummiband (194, 196) umgebenen Bündels (34) positioniert ist, Halten der Klinge ortsfest in der ausgefahrenen Position, Bewegen des Bündels (34) relativ zu der ruhenden und ausgefahrenen Klinge (100), so daß die Klinge (100) mit dem Gummiband (194, 196) in Kontakt gebracht wird, wobei ein ununterbrochenes Weiterbewegen des Bündels (34) das Gummiband (194, 196) vom Bündel (34) abzieht, ohne das Gummiband (194, 196) zu zerschneiden, und Entfernen des vom Band befreiten Bündels (34) von der Arbeitsstation. 25 30 35 40 45 50
17. Vorrichtung nach Anspruch 16, dadurch gekennzeichnet, daß die Bandgreifvorrichtung vor dem Schritt des In-Kontakt-bringens von Klinge (100) und Band (194, 196) eine pendelartige Schwingbewegung ausführt und in T il der Bandgreifvorrichtung ein in Längsrichtung um-

fassendes Gummiband (196) berührt, wobei die Aufwärtsbewegung der pendelartigen Schwingbewegung das Gummiband (196) von mindestens einer Seite des Bündels (34) abzieht.

18. Vorrichtung nach Anspruch 17, dadurch gekennzeichnet, daß das Bündel (34) zwischen einem ersten Satz Klemmen zusammengedrückt wird, bevor die Klinge in das Bündel eingeführt wird, wobei die Klemmen auf den hinteren Teil des Bündels drücken; der Satz Klemmen wird dann in Laufrichtung des Vorgangs bewegt, um das Bündel (34) im Anschluß an eine pendelartige Schwingbewegung der Bandgreifvorrichtung relativ zur Klinge (100) neu zu positionieren; das Bündel (34) wird dann vor der erneuten Einführung der Klinge von einem zweiten Satz Klemmen, die sich gegen den vorderen Teil des Bündels richten, zusammengedrückt, wonach der erste Satz Klemmen zurückgezogen wird.

Revendications

1. Un appareil pour enlever une bande de fixation (194, 196) qui entoure un paquet (34) d'articles empilés, l'appareil comprenant : un moyen de transport (24) pour supporter le paquet (34) ; et un moyen de prise de bande incluant une lame (100) mobile depuis une position rétractée vers une position étendue à laquelle la lame est positionnée entre des articles adjacents d'un paquet supporté par le moyen de transport (24), lequel appareil est caractérisé par un moyen actionneur (144) fonctionnant pour déplacer un paquet (34) entouré par une bande élastique par rapport à la lame étendue et stationnaire (100) suivant une direction pour amener la lame (100) en contact avec la bande élastique (194, 196) de sorte que la bande est tirée depuis le paquet par la lame pendant le déplacement continu du paquet (34) sans couper la bande.
2. Un appareil conforme à la revendication 1, dans lequel le contour du paquet (34) est entouré par la bande (194).
3. Un appareil conforme à la revendication 1 ou 2, dans lequel le moyen de transport (24) comprend un mécanisme de serrage.
4. Un appareil conforme à l'une quelconque des revendications précédentes, dans lequel le moyen de prise de bande comprend en outre un moyen fendeur (90) monté pour s'insérer entre les deux articles adjacents du paquet

- (34) pour maintenir une fente entre les articles adjacents pendant l'insertion de la lame (100), le moyen fendeur (90) comprenant : une lame fendeuse (90) ayant des faces parallèles ; et un mécanisme de déplacement de fendeur (86, 92, 112) pour maintenir les faces de lames fendeuses généralement parallèles aux faces des articles adjacents pendant l'insertion de la lame fendeuse (90) entre les articles adjacents et pour tourner le fendeur après l'insertion afin que les faces de la lame fendeuse (90) soient généralement perpendiculaires aux faces des articles adjacents et une fente soit maintenue entre les articles adjacents.
5. Un appareil conforme à l'une quelconque des revendications précédentes, comprenant en outre un moyen de positionnement (21) pour positionner le paquet (34) relativement au moyen de prise de bande.
 6. Un appareil conforme à la revendication 5, comprenant en outre un moyen convoyeur (30) pour conduire des paquets (34) vers le moyen de positionnement (21).
 7. Un appareil conforme à la revendication 6, comprenant en outre une plateforme (44) pour supporter un paquet (34) ; et un moyen détecteur (47) pour détecter qu'un paquet (34) arrive à la plateforme (44) et pour arrêter le moyen convoyeur (30) lorsqu'un paquet (34) est détecté.
 8. Un appareil conforme à l'une quelconque des revendications 5 à 7, dans lequel le moyen de prise de bande comprend en outre un moyen à buse d'air (80) positionnable pour diriger un jet d'air vers une face de côté d'un paquet (34) maintenu par le moyen de positionnement (21) ou par le moyen de transport (24) de manière à ouvrir une fente entre deux articles adjacents du paquet (34).
 9. Un appareil conforme à la revendication 8, utilisé avec un paquet (34) d'articles empilés fixés par une bande élastique de cerclage suivant le sens de la longueur (196), dans lequel la lame (100) est montée à pivotement pour un déplacement dans un plan parallèle aux faces des articles d'un paquet (34) maintenu par le moyen de positionnement (21) ou par le moyen de transport (24) ; et un moyen actionneur (108) déplace à pivotement la lame (100) en contact avec la bande élastique de cerclage suivant le sens de la longueur (196) et enlève la bande élastique (196) depuis au moins une face d'extrémité du paquet (34) sans couper la

bande (196).

10. Un appareil conforme à la revendication 9, dans lequel la lame (100) est adaptée pour déplacer une portion de la bande élastique de cerclage suivant le sens de la longueur (196) autour d'une paire de coins (218) du paquet (34) où deux faces de côté (208, 212) du paquet (34) rencontrent une face avant (202) du paquet (34) et où les deux faces de côté (208, 212) rencontrent une face arrière (204) du paquet (34).
11. Un appareil conforme à l'une quelconque des revendications 8 à 10, comprenant en outre des détecteurs (40) pour confirmer que chaque paquet (34) sur la bande de convoyeur (30) est convenablement présenté, et pour signaler la position d'un paquet (34) le long de son trajet ; et un moyen de commande programmé sensible aux détecteurs pour faire fonctionner la bande de convoyeur (30), le moyen de positionnement (21), le moyen actionneur (56), le moyen à buse (80), le mécanisme de déplacement de fendeur (86, 92, 112) et le moyen de transport (24).
12. Un appareil conforme à l'une quelconque des revendications précédentes, dans lequel la lame (100) a une détente (101) à son extrémité distale pour crocheter des bandes élastiques (194, 196).
13. Un appareil conforme à l'une quelconque des revendications précédentes, comprenant en outre un moyen d'empilement pour empiler des paquets débandés dans un magasin (116).
14. Un appareil conforme à la revendication 13, dans lequel le moyen d'empilement comprend un moyen de serrage (24) pour venir au contact des faces avant et arrière (202, 204) d'un paquet débandé (34), un moyen actionneur (144) pour déplacer le moyen de serrage (24) et un quelconque paquet associé (34) entre une position adjacente à la lame (100) et une position sur le magasin (116) ayant une paroi latérale rigide (118) ; un moyen actionneur (160) pour déplacer le moyen de serrage (24) et un quelconque paquet associé (34) entre une position audessus du magasin (116) et une position à l'intérieur du magasin (116) ; et un élément support (180) pour maintenir des paquets insérés (34) en alignement face avant (202) vers face arrière (204) et contre la paroi (118) du magasin (116).

15. Un appareil conform à l'une quelconqu des revendications précédentes, comprenant un moyen de chute (114) localisé pour collecter des bandes élastiques (194, 196) après qu'elles soient enlevées d'un paquet (34), des paires de brosses positionnées le long de la bande de convoyeur pour centrer et supporter des paquets passants ; un élément support pour maintenir des paquets en alignement face avant vers face arrière et contre la paroi du magasin après qu'ils soient insérés par le moyen de transport et pour appliquer une pression afin de faire avancer le magasin. 5 10
16. Un procédé de retrait d'uni bande (194, 196) 15 qui entoure un paquet (34) d'articles empilés, comprenant les étapes de : présenter le paquet (34) à un poste de travail ; maintenir la paquet (34) en position au poste de travail ; insérer le moyen de prise de bandes incluant 20 une lame (100) entre des articles adjacents du paquet (34) ; amener la lame (100) et la bande (194, 196) en contact l'une avec l'autre ; caractérisé par les étapes de : étendre la lame (100) d'une position rétractée à une position étendue 25 de sorte que la lame (100) soit localisée à la position étendue entre les articles adjacents du paquet (34) entouré par une bande élastique (194, 196) ; maintenir la lame (100) stationnaire à la position étendue ; déplacer le paquet (34) 30 relativement à la lame stationnaire et étendue (100) de sorte que la lame (100) soit amenée au contact de la bande élastique (194, 196), le déplacement continu du paquet (34) tirant la bande élastique (194, 196) du paquet (34) sans couper la bande élastique (194, 196) ; et décharger le paquet débandé (34) depuis le poste de travail. 35
17. Un procédé conforme à la revendication 16, selon lequel avant que l'étape d'amener la lame (100) et la bande (194, 196) en contact l'une avec l'autre soit effectuée, le moyen de prise de bande oscille d'une manière analogue à un pendule et une portion du moyen de 40 prise de bande entre en contact avec la bande élastique de cerclage suivent le sens de la longueur (196) et le déplacement vers le haut de l'oscillation analogue au pendule tire la bande élastique (196) depuis au moins une face 45 du paquet (34). 50
18. Un procédé conforme à la revendication 17, selon lequel le paquet (34) est compressé entre un premier jeu de mâchoires de serrage 55 avant que la lame soit insérée dans le paquet, les mâchoires de serrage serrant une portion de queue du paquet ; le jeu de mâchoires de

serrage est déplacé vers le bas pour repositionner le paquet (34) relativement à la lame (100) après l'oscillation du moyen de prise de bande d'une manière analogue à un pendule ; et comprimer le paquet (34) entre un second jeu de mâchoires de serrage appliqué contre une portion de bord de tête du paquet avant de réinsérer la lame, et puis retirer le premier jeu de mâchoires de serrage.

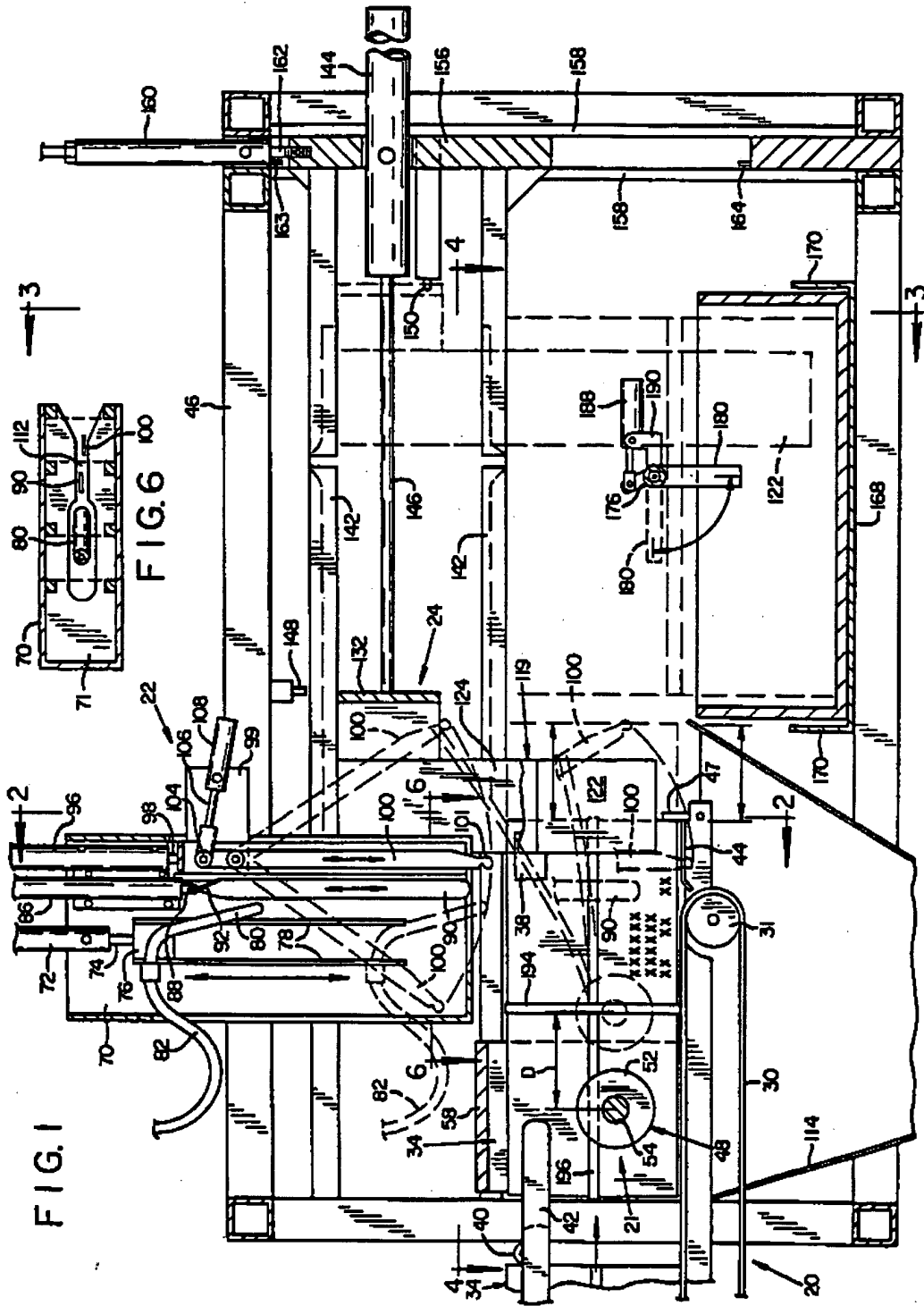


FIG. 2

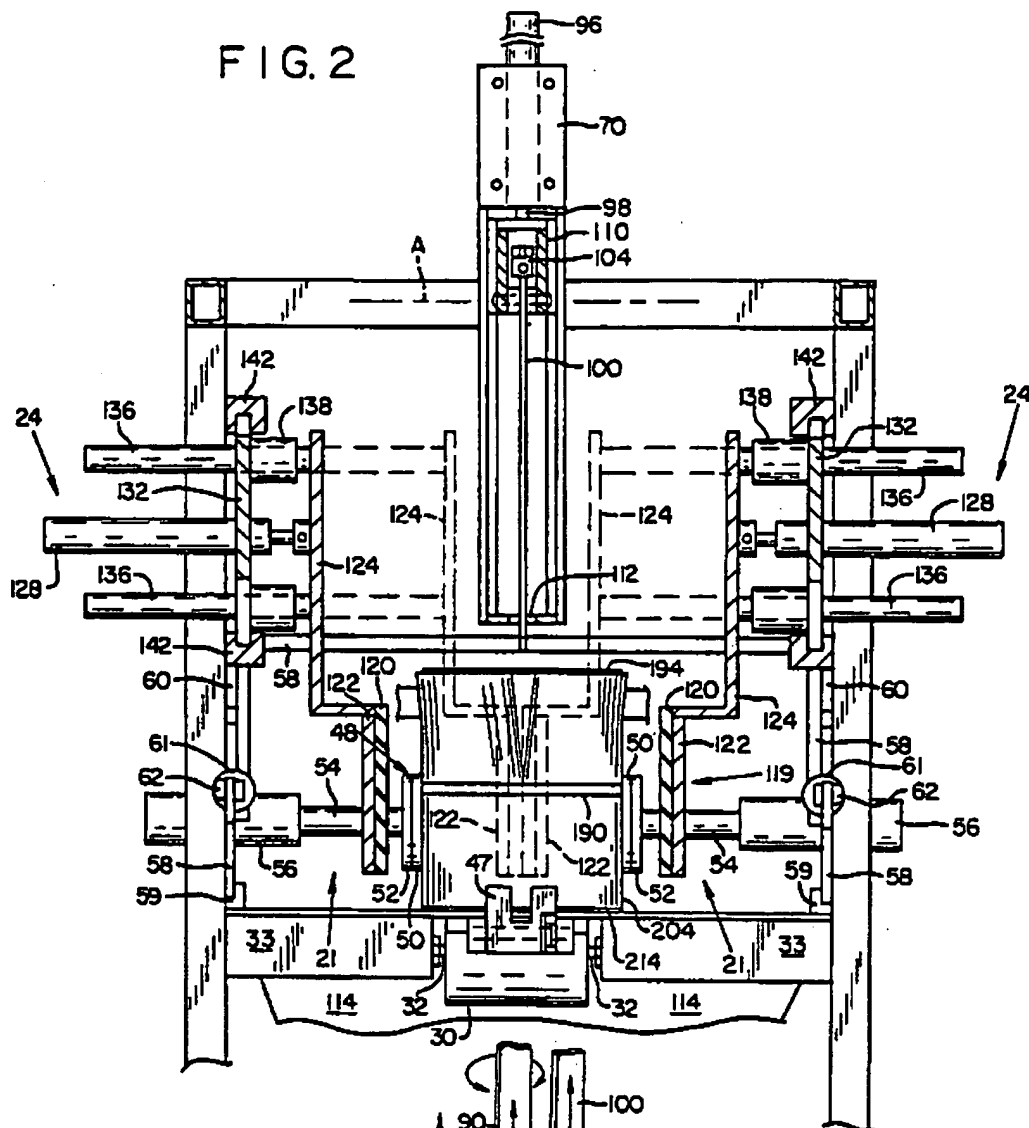


FIG. 7

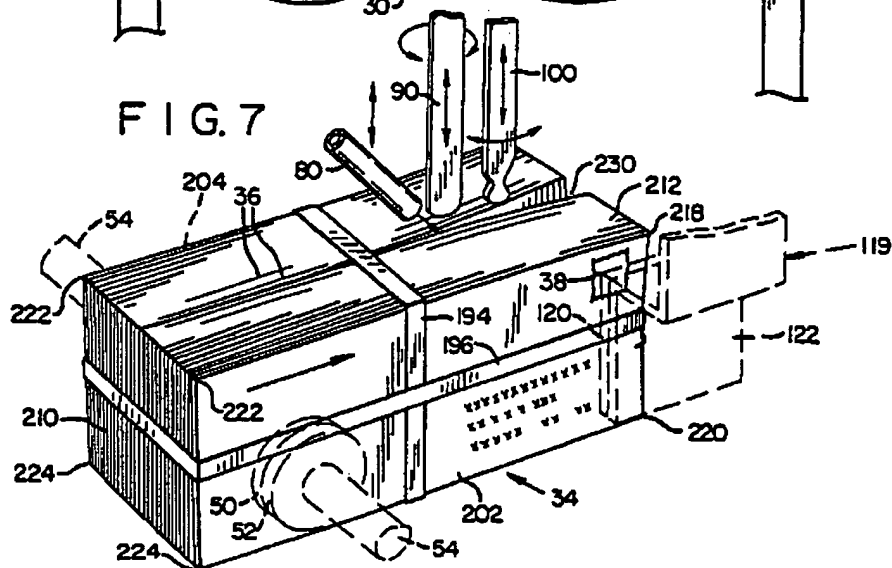


FIG. 3

